#1 RCISSUE

500.30789R00

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicants: FUKUSHIMA et al.

Serial No.: 07/800,009 (filed November 29, 1991)

Patent No.: 5,454,073 issued September 26, 1995

For: DRAWING MANAGEMENT DEVICE HAVING ABILITY TO RETRIEVE AND DISPLAY A DESIRED AMOUNT OF DATA WITHIN A DESIRED DISPLAY TIME

Group: 2301

Examiner: C. Vo

REISSUE APPLICATION

Assistant Commissioner
for Patents
Washington, D.C. 20231

September 25, 1997

Sir:

1. X This paper is in support of a request for a reissue application under 35 USC §251 of U.S. Patent No. 5,454,073, issued September 26, 1995 (hereinafter "original patent" or "subject patent'), having the title of DRAWING MANAGEMENT DEVICE HAVING ABILITY TO RETRIEVE AND DISPLAY A DESIRED AMOUNT OF DATA WITHIN A DESIRED DISPLAY TIME, and having the following inventorship (hereinafter "Inventor", "Inventors" and/or "Inventorship"):

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2. X In accordance with the requirements under 37 CFR §1.121(e) and 37 CFR §1.173:
   a. X Submitted herewith is a specification of the reissue application, including the entire specification and claims of the patent, with the matter to be omitted by reissue enclosed in square brackets, and any additions made by the reissue being underlined, so that the old and new specifications and claims may be readily compared (i.e., the specification consists, at least in part, of cut-up soft copies of the original patent, with only a single column of the printed patent securely mounted on a separate sheet of paper; and, changes, additions or deletions previously made by a Certificate of Correction to the original patent before reissue have been made without using underlining or brackets);
   b. X Claims have not been renumbered, and the numbering of claims added by reissue follows the number of the highest numbered patent claim; and
   c. X It is understood, in accordance with 35 USC §251, that no new matter shall be introduced into an application for reissue, and it is respectfully submitted that no new matter has been introduced into the present application.

3. X In accordance with the drawing requirements set forth under 37 CFR §1.174 (and also MPEP §1413):
   a. X As no changes whatsoever (not even cancellation of any drawing or drawing sheet) are to be made in the drawings, it is respectfully requested that the drawings upon which the original patent was issued be used in the reissue application, and in accordance therewith, submitted herewith are temporary drawings consisting of a copy of the printed drawings of the patent or a photoprint of the original drawings of the size required for original drawings. In accordance with the above request, submitted herewith under separate cover is a letter requesting transfer of the drawings from the patent file to the reissue application;
   b. ___ As changes are to be made to the drawings, submitted herewith are sheets containing amended reissue drawings.

4. X As provided for in 35 USC §111 and 37 CFR §1.53 (and also MPEP §1410.01), it is respectfully requested that this application be afforded a filing date as Applicant's application materials enclosed herewith contain the following which meet the requirements for a filing date as set forth in 37 CFR §1.53:
   a. X a specification containing a description pursuant to 35 USC §112 and 37 CFR §1.71;
   b. X at least one claim pursuant to 35 USC §112 and 37 CFR §1.75;
   c. X a drawing, if required pursuant to 35 USC §113 and 37 CFR §1.81(a), or if described in the specification; and
   d. X an identification of the name of the actual inventor or inventors as required by 37 CFR §1.41.

5. X In view of the above, the **filing fee** has been calculated as follows:

Excess Claims Fee:	
26 total reissue claims - 20 minimum paid X $22.00	**$ 132.00**
8 total reissue indep. - 3 minimum paid X $78.00	**+ $ 390.00**
Multiple Dependent Claims:	+ $ 0.00
Basic Filing Fee:	+ $ 770.00
Total of Above Fees:	$ 770.00
Reduction by 50% for filing by small entity (if applicable):	- $ 0.00
Total Filing Fee:	**$ 1292.00**

6. X With regard to payment of the filing fee:
   a. ___ A check including the amount of $___ is enclosed;
   b. X Authorization is herein given to charge the amount of $ 1292.00 to Deposit Account No. 01-2135 (referencing case No. 500.30789R00);
   c. ___ Payment of filing fee together with surcharge will be submitted after the filing date in accordance with the provisions of 37 CFR §1.53 (see also MPEP §1410 and MPEP §1410.01).

7. X It is understood, in accordance with 35 USC §251, that no reissued patent shall be granted enlarging the scope of the claims of the original patent unless applied for within two years from the grant of the original patent. As this reissue application is being filed within two years of the original patent grant, claims may be and are presented with the original reissue filing which are broader, or may be presented later even if such claims are not submitted until more than two years after the patent grant and are broader in scope than both the original patent claims and broadening reissue claims originally submitted, MPEP §1412.03.

8. X In accordance with the requirements under 35 USC §251, 37 CFR §§1.171 and 1.178 that the application must be accompanied by an offer to surrender the original patent, Applicant herein offers to surrender the original patent.

9. X In accordance with the requirement under 37 CFR §1.178 (and also MPEP §1416) that either the original patent, or an affidavit or declaration as to loss or inaccessibility of the original patent, must be received before allowance of the reissue application:
   a. X Applicant refrains from submitting such original patent, or affidavit or declaration as to loss or inaccessibility, until a later time (e.g., until indication of allowable reissue subject matter) as such action is advantageous in that the original patent will not have to be returned from USPTO to Applicant in the event that this reissue application is ultimately not allowed;
   b. ___ Submitted concurrently herewith is the original patent;
   c. ___ Submitted concurrently herewith is an affidavit or declaration as to loss or inaccessibility of the original patent;
   d. ___ Applicant respectfully requests that the previously surrendered original patent be transferred from the abandoned reissue application _____ to

this reissue application (MPEP §1416).

10. X In accordance with the provisions of MPEP §1416, if the original patent is not being surrendered herewith the filing of this reissue application, a photocopy of the original patent is submitted herewith for use in calculation of the reissue filing fee and for verification of other identifying data.

11. X In accordance with the signing and swearing requirements set forth under 37 CFR §1.172, a reissue oath or declaration in support of this reissue application:
    a.__ is submitted herewith;
    b. X will be filed at later time within the time period set under 37 CFR §1.53 and accompanied by any appropriate late filing surcharge fee (MPEP §1410 and MPEP §1410.01, MPEP §1414).

12. X In accordance with the assent requirements set forth under 37 CFR §1.172 that the oath be accompanied by the written assent of all assignees, if any, owning an undivided interest in the patent:
    a.__ A written assent of all assignees is being filed concurrently herewith;
    b. X A written assent of all assignees will be filed at later time within the time period set under 37 CFR §1.53 (see also MPEP §1410.01) and accompanied by any appropriate late filing surcharge fee.
    c.__ It is respectfully submitted that no written assent is required owing to the fact that the subject patent is unassigned.

13. X In accordance with the provisions of MPEP §1417, it is understood that a previous claim for the benefit of an earlier filing date in a foreign country under 35 USC §119 in the original patented application will not be automatically carried over to the reissue application, and that such claim must be separately made in this reissue application, and that the following is submitted:
    a.__ No claim is made for benefit at this time;
    b. X Priority of foreign application No. JP 2-329009, filed on November 30, 1990, in Japan, and priority of foreign application No. JP 2-329017, filed on November 30, 1990, in Japan (both claimed for priority in the prior application) are claimed under 35 USC §119;
    c. X The certified copy of the priority applications were filed on in prior application Serial No. 07/800,009, filed November 29, 1991;
    d.__ Attached herewith under separate cover letter is a certified copy of each priority application;
    e.__ A certified copy of each priority application will be filed at a later time.

14. X It is understood that the Commissioner, in accordance with the provisions of 35 USC §251 and 37 CFR §1.177, may issue several reissued patents for distinct and separate parts of the thing patented, upon demand of the applicant, and upon payment of the required fee for a reissue for each of such reissued patent, and in accordance therewith:
    a. X Applicant respectfully submits that this application represents, and should be issued as, a sole reissue patent;
    b.__ Applicant respectfully submits that this application represents one of several

reissue applications filed from the original patent.

15. X In accordance with the indication in 37 CFR §1.172(b) that a reissue will be granted to the original patentee, his legal representative or assigns as the interest may appear, it is respectfully requested that the reissue be granted to:
    a.___ the original patentee;
    b.___ the original patentee's legal representative given as _____.
    c. X the assignee Hitachi, Ltd.

16. X Address all future communications regarding the application to:

ANTONELLI, TERRY, STOUT & KRAUS, LLP
Suite 1800
1300 North Seventeenth Street
Arlington, Virginia 22209
TEL: (703) 312-6600
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17. X To an extent necessary at this application filing stage and throughout a prosecution of the present application, Applicant petitions for extension of time under 37 CFR §1.136 as required for timely filing of all papers (including amendments and responses). Further, to an extent necessary at this application filing stage and throughout a prosecution of the present application, the Commissioner is hereby authorized to charge any extension of time fees, and any other fees under 37 CFR §1.16 and §1.17 as required in conjunction with filed papers and otherwise required to maintain a pendency of this application (excluding the Issue Fee) to Deposit Account No. 01-2135 (referencing case No. 500.30789R00). A duplicate of this sheet is attached.

Respectfully submitted,

Paul J. Skwierawski

Paul J. Skwierawski
Registration No. 32,173
ANTONELLI, TERRY, STOUT & KRAUS, LLP

PJS/
Attachments:
reissue application and drawings
copy of original patent
Request for Transfer of Drawings

DRAWING MANAGEMENT DEVICE HAVING ABILITY TO RETRIEVE AND DISPLAY A DESIRED AMOUNT OF DATA WITHIN A DESIRED DISPLAY TIME

BACKGROUND OF THE INVENTION

The present invention relates to a drawing management device for managing the drawings of facilities, such as a pipe laying system of a water and gas supply, a wiring system for electric power and telephone, a road for vehicles, etc., in the form of digitized information. It should be noted that the term 'drawing' as used herein refers to a drawing of the facility, such as a water supply, a machine design drawing, a road traffic map, etc.

Traditionally, the state of facilities, such as a pipe system for water and gas supply, and a wiring arrangement for electric power and telephone communication, has been provided in the form of a drawing drafted on a sheet of paper or polyester film. In this case, each change in the facilities requires a modification to be made to the drawing. The work of modifying the drawing must be performed manually with the result that a long time and much labor are required and also the possibility that errors will be made in modifying the drawing is relatively strong. In order to solve such a problem, it has been proposed to manage the facility drawing in the form of its digitized information. More specifically, as disclosed in JP-A-63-254565, the management is performed by displaying the many facility drawings (e.g., topography drawings, system drawings and symbol drawings) stored is digital data in a file device on a display device under computer control. The work for modifying the drawings is also made under computer control for the drawings displayed on the display device.

However, the above prior art has the following defects. In displaying large scale drawing data including e.g. qualifying lines, the processing therefor is executed at a very low speed since the data amount to be drawn or displayed during a unit time is very large. This is because even if only a part of the drawing is required, all the data including minute and detailed character information, which is difficult to recognize, are displayed. Therefore, the above prior art system is poor in its usability and efficiency as a facility display system.

The present invention has been accomplished in order to eliminate the above defect of the prior art, and intends to provide a drawing management device that can surely attain a user (operator)'s objectives, i.e. has a function of displaying the object required by a user swiftly and exactly. This is because, where very detailed drawing information is not necessary, it is important to display only the drawing information within the range required by an operator as soon as possible, but not all of the items of the stored detailed drawing information.

SUMMARY OF THE INVENTION

An object of the present invention is to provide a drawing management device that can swiftly display drawing information with a degree of detail desired by an operator.

In order to attain the above object, a certain limit is given to the displaying time and priorities are automatically allotted to display objects located at several levels so that all necessary and a minimum amount of information can be displayed within a limited time.

The priorities of drawing data relative to the facility for

water supply are automatically allotted at three to five levels. An operator updates the priority in sequence from history information with a changed display level, thereby to provide a desired drawing swiftly.

The above and other objects and features will be more apparent from the following description taken in conjunction with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a block diagram of an arrangement of a drawing management device according to one embodiment of the present invention;

FIG. 2 is a block diagram for explaining the operation and function of the drawing management device according to the above embodiment;

FIGS. 3A and 3B are views showing the relationship between drawing arrangements stored in a file device and graphic coordinate positions;

FIGS. 4A, 4B, 4C and 4D are views showing level arrangements of graphic data;

FIG. 5 is a view for explaining the priorities of display;

FIGS. 6A, 6B and 6C are views showing examples of displayed drawings according to selected priorities;

FIG. 7 is a flowchart showing the processing flow in a priority display control unit;

FIG. 8 is also a flowchart showing the processing flow in a priority display control unit; and

FIGS. 9A and 9B are views showing the graphic data capacity for each drawing and the three-dimensional shape of a retrieval icon corresponding to it, respectively;

FIG. 10 is a table for explaining the process of changing the priority allotted for each level number in accordance with the history of the operation of changing the level to be displayed;

FIG. 11 is a flowchart of the processing shown in FIG. 10;

FIG. 12 is a flowchart of the process of making a display priority table in accordance with a display time;

FIGS. 13A and 13B are a graph showing the distribution of the frequency for each level for each display time, and a graph showing the total time of display verses frequency.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring now to the drawings, an explanation will be given of one embodiment of the present invention.

FIG. 2 shows the basic arrangement for explaining the operation and function of one embodiment of the present invention shown in FIG. 1.

In FIG. 2, facility drawing data is stored in a file device 203. The facility drawing data may include graphic or figure data of topography, tube (i.e., pipe) paths, and the like, and attribute data (the name of a town , the name of an individual, the diameter of a tube, the kind (e.g. vinyl) of the tube, etc.) expressed by characters and numerical values relative to the graphic representation. The graphic data to be stored in file device 203 is supplied from a drawing input device 204, which operates in such a manner that a drawing drafted on a sheet of paper is scanned at regular intervals in accordance with the light and dark areas of the read data so that a digital image thus obtained provide encoded data.

The facility drawing may be composed of a plurality of drawings, such as shown in FIG. 3A, which are individually

separated to provide graphic data files.

The graphic data is expressed on rectangular coordinates as shown in FIG. 3B. The lengths in the X and Y directions are determined by the size of the drawing concerned. This graphic data is expressed in such a way that it is separated in plural levels such as, a level **42** including road data **45** (FIG. 4B), a level **43** including house corner data (FIG. 4C) and a level **44** including tube path data **47** (FIG. 4D). The data located at these levels when superposed as required to provide the entire graphic data is shown as a level **41** (FIG. 4A).

On the other hand, the attribute data is supplied to the file device **203** from a data inputting device, which collectively supplies data from a keyboard **206** or a floppy disk **208**.

An operator manipulates a mouse **207** to display the drawing on a display device (CRT) **205** as follows. First, the operator manipulates the mouse **207** to move a cursor CU to one of a plurality of icons for selecting functions displayed on the CRT screen so that the function intended is specified. If the icon for 'drawing retrieval' is specified, a central processing unit (CPU) searches the drawing data concerned (composed of graphic data and related attribute data) to be temporarily stored in a main memory **202**. The main memory **202** operates to store the programs for executing the processings, such as search and editing of the drawing data, as well as the drawing data being processed. The drawing data temporarily stored in the main memory **202** is edited by the CPU **201** in accordance with the valid display coordinate that is a display region of the CRT **205**, and thereafter the edited data is displayed on the CRT **205**. The operator can recognize the contents of a desired or objective drawing from the displayed image.

Further, in order to recognize the details of the drawing, the image is displayed so as to be partially enlarged. To this end, the cursor CU is moved using the mouse **207** to specify any square region within the CRT display region in terms of ends of a diagonal line so that a part of the drawing is enlarged or reduced. Actually, a part of the drawing data concerned stored in the main memory **202** is edited in an enlarged or reduced way, and the drawing data thus edited is displayed on the CRT **205**.

An explanation will be given of the level display with priorities that permits a desired drawing to be displayed within a predetermined time.

FIG. **1** shows a block diagram of one embodiment of the present invention in which the CPU **201** executes the processing of level display with priorities. In FIG. **1**, the display screen or field **101** is composed of an icon region **102** where the mouse is manipulated to select the function of retrieval or searching and displaying a desired drawing, and a drawing displaying region **103** where the drawing retrieved by mouse manipulation is displayed. The mouse **207** is used to select the function from the icon region **102** and to specify the location of the drawing to be displayed on the drawing displaying region **103**. The keyboard **206** is used to set the condition of searching a drawing. The data inputted from the keyboard **206** and the mouse **207** are supplied to an operation input unit **104** in the CPU **201**. The drawing data is previously stored in the file device **203**.

An explanation will be given of the relationship between the function of each of the functional units within the CPU **201**, and an operation of manipulation and display.

A desired drawing is retrieved or searched using an index drawing, drawing number, etc. and thereafter is displayed on the display device. The operation of the CPU **201** in such a

display processing process will be explained below. First, using the mouse **207**, the item 'drawing retrieval' is selected or designated on the icon region **102** for mouse manipulation. This selective designation is inputted to a manipulation input section **104** thereby to activate a priority display control section **105**. The priority display control section **105** directs a graphic retrieval section **106** to retrieve the desired drawing (data). Further, when the level to be displayed in the graphic data retrieved from the graphic file **203** is changed, the priority display control section **105** serves to automatically change the priority level for the corresponding level on the display priority table previously defined in accordance with the changing history of the level concerned. Specifically, as shown in FIG. **10**, the priority allotted for each level number is changed in accordance with the history of the operation of changing the level to be displayed. If the operation is directed to addition of the level to be displayed, the priority of the level number concerned is decreased by 1, and if it is directed to cancellation of the level to be displayed, the priority is increased. It should be noted that the amount of changing the priority must be limited in the range between a minimum value and a maximum value which are previously defined.

FIG. **11** shows the flow of the processings illustrated in FIG. **10**. First, in step **1101**, when the operator initiates the operation of selecting the level to be displayed, the presence or absence of addition/cancellation of the level to be displayed is designated for the level number concerned on the display priority table. In step **1102**, the amount of changing the priority for each level number is calculated as −1 or +1 in accordance with the presence or absence of the addition/cancellation of the level to be displayed. In step **1103**, the priority due to the history of changing the level to be displayed is calculated on the basis of the above calculation result. In step **1104**, the priority after the history change is checked to see if it is within the allowable range. If it is within the allowable range, in step **1105**, the priority after the history changing is directly written in the display priority table. If it is outside the range, in step **1106**, where it is smaller than the minimum limit, the allowable minimum priority is written in the display priority table, and where it is larger than the upper limit, the allowable maximum priority is written in the display priority table.

The method of defining the display priority table of FIG. **5** during a displaying time will be explained below. FIG. **12** shows the process of making the display priority table of FIG. **5** during the displaying time. First, in step **1201**, a table of the capacity of the graphic data for each level as shown in FIG. **9A** is made for any drawing specified by the operator. In step **1202**, using the graphic data capacity table for each level, the time required for display is calculated on the basis of the amount of data displayed per unit time. In step **1203**, a graph (FIG. **13A**) showing the distribution of the frequency for each level which depends on an individual time slot is formed. In step **1204**, a graph showing the total display time as shown in FIG. **13B** is made on the basis of the above graph showing the distribution. In step **1205**, the display priority levels at e.g. five stages are successively allotted on the graph showing the total display time in accordance with the total display times. In step **1206**, the average display times corresponding to the display priority levels at five stages are calculated. Specifically, the total display time corresponding to each priority level is divided by its frequency to calculate the average display for each priority level. Finally, in step **1207**, a priority is allotted to the level corresponding to the average display time and the

priority is written on the display priority table.

Returning to FIG. 1 again, when the graphic retrieval section **106** has retrieved the drawing data, a priority display processing section **107** is activated. Then, the amount of data which can be displayed during the display time previously set by a user or operator is calculated, and the amount of data is reported to the priority display processing section **107**. The graphic retrieval section **106** retrieves the drawing data from the drawing files in the file device **203** on the basis of the number of the desired drawing and stores the retrieved drawing data in the main memory **202**; it sends the data to the priority display processing section **107** immediately after retrieval of all the desired data has been completed. The priority display processing unit **107** takes in the drawing data and sequentially sends the drawing data at the level to be displayed to a display editing section **110** on the basis of a display priority table (FIG. 5) and the amount of data to be displayed within the prescribed time. The display editing processing section **110** draws the desired drawing on the drawing display region **103** on the basis of the drawing data sent.

FIG. 5 shows display priority tables on which the numbers of levels and their priority are stored. In this table, the smaller number of priority is defined as having a higher priority, but may be defined in a way reverse thereto.

FIGS. 6A, 6B and 6C show examples of drawings displayed for individual priorities. FIG. 6A shows a drawing **61** displayed with the priority of 1 in which the most important level group including a road **64**, a water supply tube path **65** and a symbol **66** on the water supply tube path **66** is displayed. FIG. 6B shows a drawing **62** displayed with the priority of 2 in which a house corner level **67** is superposed on the graphic data with the priority of 1. FIG. 6C shows a drawing **63** with the priority of 3 in which the level relative to water supply devices **67** is superposed on the graphic data with the priorities of 1 and 2.

FIG. 7 shows the processing flow in the priority display control section **105**. First, in step **701**, the amount of data that can be displayed during a prescribed display time t is calculated using the following equation:

$$D_{max}=tD_0 \quad (1)$$

where D_{max}: the largest amount of data which can be displayed during the time t

t: prescribed display time

D_0: the amount of data displayed during a unit time

In step **702**, the amount of displayed data corresponding to a priority i is calculated, and in step **703**, the request of data display with the priority of i is reported to the priority display processing section **107**. Finally, in step **704**, the total amount of displayed data up to the priority of i is calculated and the calculated amount of data is compared with the largest amount of data that can be displayed. If the former is within the range of the latter, the processing for the succeeding priority of i+ 1 is repeated.

FIG. 8 shows the processing flow in the priority display processing section **107**. First, in step **801**, the level corresponding to the priority of i is retrieved from the display priority table. In step **802**, the display data corresponding to the level concerned is retrieved from the graphic retrieval section **106** and the retrieval result is supplied to the graphic editing section **110**.

In this way, only the graphic data corresponding to the prescribed retrieval time can be automatically selected so that the drawing data with a high priority can be retrieved

without being influenced by the complexity of the drawing concerned.

In designating the item 'drawing retrieval', in order to previously recognize the data capacity corresponding to the drawing data, a process reflecting the approximate data capacity of the drawing concerned on the icon to be retrieved will be performed as follows.

The mouse **207** is manipulated to move the cursor CU to the icon region **102** so that the icon of the item 'capacity three-dimensional display' is selected or designated on the icon region **102**. This selective designation is inputted to the manipulation input section **104** of the CPU **201**, and thereafter a request for the capacity of the three-dimensional display is reported to an icon three-dimensional display processing section **109**. In previously registering drawing data in graphic files of the file device **105**, a graphic data amount calculating section **108** calculates the capacity of the graphic data for each level and stores the calculation result on the main memory **202** as shown in FIG. **9**A. The icon three-dimensional display section **109** forms the icon shape on the basis of the total capacity of data calculated by the graphic data amount calculation section **108** using the table of graphic data capacities (FIG. **9**A) on the main memory **202** in accordance with the level of the desired drawing to be displayed. As seen from FIG. **9**B, the icon shape is formed so that the depth of the three-dimensional icon corresponds to the capacity of the graphic data. The depth of the icon is converted from the maximum value of graphic data capacity previously defined as 100%. The three-dimensional icon is edited by the display editing section **110** as drawing data on the icon region **102** and the edited drawing data is displayed on the drawing display region **103**.

In this way, the approximate data capacity of the drawing can be easily determined from the icon shape prior to the drawing retrieval so that the time taken for the retrieval and data processing can be recognized swiftly and easily.

The present invention can be applied to a so-called navigation device mounted in a car which can quickly display road traffic information on a display device.

We claim:

1. A drawing management and display device for displaying digital information of a system drawing, showing an entire system having a plurality of information items, within a desired display time, said drawing management and display device comprising:

a means for referencing a total display time required for displaying said system drawing, for determining a plurality of different display time priority levels each having a different display time which is shorter than said total display time, and for storing said system drawing as a plurality of sub-drawings each representing the same area of said system drawing and having a different number of said plurality of information items which make up said entire system such that display of each of said sub-drawings can be accomplished within a different said different display time, said sub-drawings being stored with respective priorities each of which represents an ability to display the sub-drawing within a different said different display time;

a selective display designating means for automatically selecting one of said sub-drawings stored in the storing means on the basis of the priority thereof in order to accomplish display within said desired display time; and

a means for displaying selected said sub-drawings within said desired display time in response to said selecting

operation of said selective display designating means.

2. A drawing management and display device according to claim 1, wherein at least one of said sub-drawings includes all of the information items which make up said same area of said system drawing.

3. A drawing management and display device according to claim 1, wherein all of said sub-drawings show said information items with the same magnification.

4. A drawing management and display device according to claim 1, wherein each of the sub-drawings shows information items of a different type from the information items shown on all sub-drawings of a lower priority.

5. A drawing management and display device according to claim 4, wherein the ability to display a sub-drawing within a desired display time is determined by the number and type of information items included in the sub-drawing.

6. A drawing management and display device according to claim 1, wherein said entire system is a gas/water supply pipe-laying system.

7. A drawing management and display device according to claim 1, wherein said entire system is an electric power/telephone wiring system.

8. A drawing management and display device according to claim 1, wherein said enture system is a machine designating system.

9. A drawing management and display device according to claim 1, wherein said entire system is a road traffic information map.

10. A drawing management and display device according to claim 1, wherein said plurality of sub-drawings which represent the same area of said system drawing include at least three sub-drawings.

11. A drawing management and display device {according to claim 1, wherein said} comprising a displaying means which includes a means for displaying a three-dimensional retrieval icon for respective sub-drawings, the amount of data in a respective sub-drawing being indicated by a dimension of each respective displayed retrieval icon.

12. A drawing management and display device according to claim 1, wherein said selective display designating means includes a means for storing a table of values including indicators of respective areas of said system drawing and a priority designated for each respective area, and further including a means responsive to an indicator of an area of said system drawing for selecting a sub-drawing of that area designated by the priority in said table of values.

13. A drawing management and display device according to claim 12, further including a input means for editing said table of values to change the priority designated for a respective area of said system drawing.

14. A drawing management and display device for managing divided facility drawings having the same magnification of an entire facility as digital information, said drawing management and display device comprising:

a first means for referencing a total display time for displaying said system drawing, for determining a plurality of different display time priority levels each having a different display time which is shorter than said total display time, and for storing divided facility drawings with respective priorities each of which represents an ability to display a desired facility drawing within a different said different display time when combining at least selected ones of features of said divided facility drawings;

a drawing inputting means for editing said divided facility drawings stored in said first means;

a data inputting means for inputting attribute information to be stored in the first means;

a second means for temporarily storing said divided facility drawings stored in said first means and temporarily storing said divided facility drawings given from said drawing inputting means; and

a means for displaying said divided facility drawings stored in said second means and said attribute information.

15. An image data display method comprising a step of:

displaying on a display screen, a respective predetermined three-dimensional shape to represent each image of a drawing to be displayed such that a data amount of said image is represented by a length in a predetermined one-dimensional direction of said three-dimensional shape, wherein images belonging to a same predetermined group are each displayed on the display screen in the form of the predetermined three-dimensional shape and in a form of an icon in such a manner that an accumulated data amount of said images belonging to the same predetermined group is represented by an accumulated length in the predetermined one-dimensional direction.

16. An image data display method according to claim 15, wherein the three-dimensional shape is a rectangular parallelepiped or a cube.

17. An image data display method according to claim 15, wherein the predetermined one-dimensional direction of said predetermined three-dimensional shape is a direction at least partially in a depth of the display.

18. An image data display method according to claim 15, wherein the icon is more particularly an icon for retrieving the images belong to the same predetermined group.

19. An image data display method comprising the step of:

displaying on a display screen, a predetermined three-dimensional shape and icon to represent images belonging to a same predetermined group of a drawing to be displayed, such that an accumulated data amount of said images belonging to the same predetermined group is represented by an accumulated length in a predetermined one-dimensional direction of said three-dimensional shape.

20. An image display method comprising the step of:

displaying on a display screen, a respective predetermined three-dimensional shape and icon to represent images belonging to different predetermined groups of a drawing to be displayed, such that an accumulated data amount of said images belonging to a same predetermined group is represented by an accumulated length in a predetermined one-dimensional direction of said three-dimensional shape associated with said same predetermined group, and such that the respective predetermined three-dimensional shapes and icons for said different predetermined groups are displayed separately on said display screen.

21. An image data display method according to claim 20, wherein the respective predetermined three-dimensional shapes and icons for said different predetermined groups are more specifically displayed separately in a second one-dimensional direction which is different from said predetermined one-dimensional direction.

22. An image data display apparatus comprising:

an image data amount calculation unit which obtains an accumulated data amount for images belonging to a same predetermined group; and

an icon three-dimensional display processing unit which displays on a display screen, a respective predetermined three-dimensional shape to represent each image of a drawing to be displayed such that a data amount of said image is represented by a length in a predetermined one-dimensional direction of said three-dimensional shape, wherein images belonging to the same

predetermined group are each displayed on the display screen in the form of the predetermined three-dimensional shape and in a form of an icon in such a manner that an accumulated data amount of said images belonging to the same predetermined group is represented by an accumulated length in the predetermined one-dimensional direction.

23. An image data display apparatus according to claim 22, wherein said icon three-dimensional display processing unit displays the icon in a shape of a rectangular parallelepiped or a cube.

24. An image data display apparatus according to claim 22, wherein the predetermined one-dimensional direction of said predetermined three-dimensional shape is a direction at least partially in a depth of the display.

25. An image data display apparatus according to claim 22, wherein the icon is more particularly an icon for retrieving the images belong to the same predetermined group.

26. A drawing management and display device for displaying digital information of a system drawing, showing an entire system having a plurality of information items, within a desired display time, said drawing management and display device comprising:

a means for referencing a total display time required for displaying said system drawing, for determining a plurality of different display time priority levels each having a different display time which is shorter than said total display time, and for storing said system drawing as a plurality of sub-drawings each representing the same area of said system drawing and having a different number of said plurality of information items which make up said entire system such that display of each of said sub-drawings is accomplished within a different said different display time, said sub-drawings being stored with respective priorities each of which represents an ability to display the sub-drawing within a different said different display time;

a selective display designating means for automatically selecting one of said sub-drawings stored in the storing means on the basis of the priority thereof in order to accomplish display within said desired display time; and

a means for displaying selected said sub-drawings within said desired display time in response to said selecting operation of said selective display designating means;

wherein said displaying means includes a means for displaying a three-dimensional retrieval icon for respective sub-drawings, the amount of data in a respective sub-drawing being indicated by a dimension of each respective displayed retrieval icon.

* * * * *

#4

500.30789R00

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicants: FUKUSHIMA et al.

Appln Serial No.: 07/800,009 filed November 29, 1991

Patent No.: 5,454,073 issued September 26, 1995

For: DRAWING MANAGEMENT DEVICE HAVING ABILITY TO RETRIEVE AND DISPLAY A DESIRED AMOUNT OF DATA WITHIN A DESIRED DISPLAY TIME

Group: 2301

Examiner: C. Vo

DECLARATION AND POWER OF ATTORNEY FOR REISSUE APPLICATION

Assistant Commissioner
for Patents
Washington, D.C. 20231

Sir:

The following is for submission to the United States Patent & Trademark Office (hereinafter "USPTO"):

1. X This paper is in support of a request for a reissue application under 35 USC §251 of U.S. Patent No. 5,454,073, issued September 26, 1995 (hereinafter "original patent" or "subject patent'), having the title of DRAWING MANAGEMENT DEVICE HAVING ABILITY TO RETRIEVE AND DISPLAY A DESIRED AMOUNT OF DATA WITHIN A DESIRED DISPLAY TIME, and having the following inventorship (hereinafter "Inventor", "Inventors" and/or "Inventorship"):

Inventor:	Manabu FUKUSHIMA
City of Residence:	Hitachi-shi
State or Foreign Country:	Japan
Country of Citizenship:	Japan
Post Office Address:	33-2, Nishinarusawacho-1-chome, Hitachi-shi, Japan

Inventor:	Mikio YODA
City of Residence:	Naka-gun, Ibaraki-ken
State or Foreign Country:	Japan
Country of Citizenship:	Japan
Post Office Address:	1737-158, Shirakata, Tokaimura, Naka-gun, Ibaraki-ken, Japan

Inventor:	Kazuo TSUTSUI
City of Residence:	Hitachiota-shi
State or Foreign Country:	Japan
Country of Citizenship:	Japan
Post Office Address:	3091-1, Mayumicho, Hitachiota-shi, Japan

2. X In accordance with the signing and swearing requirements set forth under 37 CFR §1.172, this oath is being signed and sworn to, or declaration made, by all the inventors (hereinafter "Inventor", "Inventors", "Inventorship" and/or "Applicant"), i.e., in accordance with 37 CFR §1.172(a) which states that "a reissue oath must be signed and sworn to or declaration made by the inventor or inventors except as provided" (in 37 CFR §§1.42, 1.43 and 1.47).

3. X The undersigned herein complies with the oath or declaration requirements set forth under 37 CFR §1.63 as follows:

a. X The requirements set forth in 37 CFR §1.63(a) are complied with as follows:

I. X In order to satisfy the requirement set forth in 37 CFR §1.63(a)(1), it is respectfully submitted that this oath or declaration has been executed in accordance with either 37 CFR §1.66 or §1.68 as follows. More particularly, in accordance with the provisions of 37 CFR §1.68, this document is subscribed to by written declaration in lieu of an oath. The undersigned declarant acknowledges the warning that willful false statements and the like are punishable by fine or imprisonment, or both (18 USC §1001) and may jeopardize the validity of the application or any patent issuing thereon, and declarant further sets forth that all statements made of the declarant's own knowledge are true and that all statements made on information and belief are believed to be true;

II. X In order to satisfy the requirement set forth in 37 CFR §1.63(a)(2), it is respectfully submitted that this oath or declaration is directed to the specification:

A. X provided herewith this paper;

B. __ previously filed on _____;

C. __ amended by the _____ filed on _____;

III. X In order to satisfy the requirement set forth in 37 CFR §1.63(a)(3), the identity of each inventor and the residence and country of citizenship of each inventor have been provided (see above);

IV. X In order to satisfy the requirement set forth in 37 CFR §1.63(a)(4), it is respectfully stated that the inventorship of the present application is:

A.__ a sole inventorship, with the sole inventor being identified (see above);

B.X a joint inventorship, with the joint inventors being identified (see above);

b.X In accordance with the requirements set forth in 37 CFR §1.63(b), it is respectfully submitted that the undersigned:

I.X has reviewed and understands the contents of the specification, including the claims, as amended by any amendment specifically referred to in this oath or declaration;

II.X believes the named inventor or inventors to be the original and first inventor or inventors of the subject matter which is claimed and for which a patent is sought; and

III.X acknowledges the duty to disclose to the USPTO all information known to the undersigned to be material to patentability as defined in 37 CFR §1.56;

c.X In order to satisfy the requirement set forth in 37 CFR §1.63(c), that the oath or declaration in any application in which a claim for foreign priority is made pursuant to 37 CFR §1.55 must identify the foreign application for patent or inventor's certificate on which priority is claimed, and any foreign application having a filing date before that of the application on which priority is claimed, by specifying the application number, country, day, month and year of its filing, the following is respectfully identified and claimed:

02-329009 Japan filed November 30, 1990
02-329017 Japan filed November 30, 1990;

4.X Applicant herein complies with the reissue oath or declaration requirements set forth under 37 CFR §1.175 and makes oath or declaration statements as follows:

a.X Applicant verily believes, in accordance with 35 USC §251 and 37 CFR §1.175(a)(1), the original patent to be deemed wholly or partly inoperative or invalid, stating such belief and the reasons why as follows, i.e., the subject application has one or more of the "defects" appropriate for reissue as set forth in 37 CFR §1.175(a)(2-3) as follows:

Applicant claims, in accordance with 35 USC §251 and 37 CFR §1.175(a)(3), that the original patent is inoperative or invalid "by reason of the patentee claiming less than he had a right to claim in the patent," and distinctly specifies such insufficiency in the claims as follows:

> The inventors of the present application were directed (at the time of invention) toward solving a problem in that it took a large time (prior to the present invention) to display a large scale drawing. In order to solve such problem, the inventors thought of and disclosed (within the original and present patent disclosure) several technical concepts allowing large scale drawings to be display in a quicker fashion. More particularly, as one concept, the inventors disclosed an arrangement wherein priorities are assigned to display images (i.e., objects) of the drawing, and display can be controlled (limited) so as to display only images having priorities of interest. As fewer images are being displayed (i.e., priorities not of

interest are eliminated), a desired drawing can be made within a shorter time. The inventors (at the time of prosecution and allowance of the application) thought that this concept was the most important feature, and hence filed and prosecuted the application with this feature as main claims.

As another concept, the inventors considered that since different sub-drawings have differing data amounts, it would be useful to have an arrangement wherein a user could easily and quickly visually grasp or understand the data amounts for each sub-drawing, i.e., so as to allow a user the ability to conceive of how much data, and therefore drawing time, was associated with each sub-drawing. In this respect, the inventors thought of an icon (see original Fig. 9B) for symbolically representing the sub-drawings, i.e., such icon being in the form of a three-dimensional icon drawing (e.g., cube) with a data amount of each sub-drawing being represented by a corresponding length in a predetermined one-dimensional (e.g., depth) direction. By visually viewing the icons and especially the lengths thereof, a user can easily and quickly grasp how much data, and therefore, drawing time, is associated with a sub-drawing, and therefore, a user can decide (according to the user's time budget and level of interest) whether to display the sub-drawing. At the time of prosecution and allowance of the application, the inventors thought this concept was a subsidiary one, and therefore, such concept was only claimed in dependent claims (e.g., claim 11) together with the above-discussed image priority concept.

During recent review of the patent, the inventors and/or Japanese agents realized that the above-identified icon concept is not a subsidiary concept, but instead is a primary concept which should have been separately and independently claimed apart from (i.e., not with) the image priority concept. More particularly, it was realized that such icon concept is itself an inventive embodiment which is patentable over the prior art and which should have been independently claimed, and therefore, the original patent is inoperative or invalid "by reason of the patentee claiming less than he had a right to claim in the patent".

The reissue overcomes such defect in the original patent by broadening claim 11 and also submitting additional claims 15-25, to claim the icon concept separately and independently from the image priority concept. Further, the reissue also submits additional claim 26 for the purpose of retaining a claim incorporating both the image priority concept and the icon concept;

b. X Applicant, in accordance with 37 CFR §1.175(a)(5), particularly specifies the errors relied upon as the causation of the above-mentioned "defects", how and when they arose or occurred (MPEP §1414), and how and when such errors were discovered (MPEP §1414), as follows:

the errors arose during the prosecution of U.S. Application Serial No. 07/800,009 due to our failure and that of our Japanese

agents and U.S. attorneys to recognize that claim 11 originally presented and/or amended in the Amendments filed during prosecution, contained unnecessary (i.e., the image priority concept) limitations which unduly limited the scope of protection to which the present invention is entitled as a result of having failed to fully and appropriately appreciate the full scope or extent of the present invention;

c. X Applicant, in accordance with 35 USC §251 and 37 CFR §1.175(a)(6), respectfully states that the above-mentioned errors arose "without any deceptive intention" on the part of the Applicant, as evidenced by the facts set forth above;

d. X Applicant, in accordance with 37 CFR §1.175(a)(7), acknowledges the duty to disclose to the U.S. Patent & Trademark Office all information known to Applicant to be material to patentability as defined in 37 CFR §1.56.

5. X In accordance with the assent requirements set forth under 37 CFR §1.172 that the oath be accompanied by the written assent of all assignees, if any, owning an undivided interest in the patent, a separate written assent of all the assignees is being filed concurrently herewith;

6. X In accordance with the requirements under 37 CFR §1.121(e), 37 CFR §1.173, and 35 USC §251, it is respectfully submitted that no new matter has been introduced into the Reissue Application.

7. X In accordance with the requirements under 35 USC §251, 37 CFR §§1.171 and 1.178 that the application must be accompanied by an offer to surrender the original patent, Applicant herein offers to surrender the original patent.

8. X It is understood, in accordance with the provisions of 35 USC §251, that, if this Reissue Application is finally allowed, the Commissioner shall reissue the patent for the invention disclosed in the original patent, and in accordance with a new and amended application, for the unexpired part of the term of the original patent.

9. X In accordance with the indication in 37 CFR §1.172(b) that a reissue will be granted to the original patentee, his legal representative or assigns as the interest may appear, it is respectfully requested that the reissue be granted to the assignee, Hitachi, Ltd.

10. X Applicant hereby appoints as principal attorneys Donald R. Antonelli, Reg. No. 20,296; David T. Terry, Reg. No. 20,178; Melvin Kraus, Reg.No. 22,466; William T. Solomon, Reg. No. 28,565; Gregory T. Montone, Reg. No. 28,141; Ronald J. Shore, Reg. No. 28,577; Donald E. Stout, Reg. No. 26,422; Alan E. Schiavelli, Reg. No. 32,087; James N. Dresser, Reg No. 22,973; and Carl I. Brundidge, Reg No. 29,621 with full power of substitution and revocation and to transact all business in the U.S. Patent and Trademark Office connected therewith.

11. X I, the undersigned, hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are

believed to be true, and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issuing thereon.

X - EXECUTED BY ALL THE INVENTORS AS FOLLOWS:

Inventor: Manabu FUKUSHIMA

Signature: Manabu Fukushima Date: 1997. 11. 7

Post Office Address: 33-2, Nishinarusawacho-1-chome, Hitachi-shi, Japan

Inventor: Mikio YODA

Signature: Mikio Yoda Date: 1997. 11. 11

Post Office Address: 1737-158, Shirakata, Tokaimura, Naka-gun, Ibaraki-ken, Japan

Inventor: Kazuo TSUTSUI

Signature: Kazuo Tsutsui Date: 1997. 11. 10

Post Office Address: 3091-1, Mayumicho, Hitachiota-shi, Japan

PJS/

#4

500.30789R00

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicants: FUKUSHIMA et al.

Appln Serial No.: 07/800,009 filed November 29, 1991

Patent No.: 5,454,073 issued September 26, 1995

For: DRAWING MANAGEMENT DEVICE HAVING ABILITY TO RETRIEVE AND DISPLAY A DESIRED AMOUNT OF DATA WITHIN A DESIRED DISPLAY TIME

Group: 2301

Examiner: C. Vo

ASSENT OF ASSIGNEE

Assistant Commissioner
for Patents
Washington, D.C. 20231

Sir:

The following is for submission to the United States Patent & Trademark Office (hereinafter "USPTO"):

This paper is in support of a request for a reissue application under 35 USC §251 of U.S. Patent No. 5,454,073, issued September 26, 1995 (hereinafter "original patent" or "subject patent'), having the title of DRAWING MANAGEMENT DEVICE HAVING ABILITY TO RETRIEVE AND DISPLAY A DESIRED AMOUNT OF DATA WITHIN A DESIRED DISPLAY TIME, and having the following inventorship (hereinafter "Inventor", "Inventors" and/or "Inventorship"):

Inventor:	Manabu FUKUSHIMA
City of Residence:	Hitachi-shi
State or Foreign Country:	Japan
Country of Citizenship:	Japan
Post Office Address:	33-2, Nishinarusawacho-1-chome, Hitachi-shi, Japan

Inventor:	Mikio YODA
City of Residence:	Naka-gun, Ibaraki-ken
State or Foreign Country:	Japan
Country of Citizenship:	Japan
Post Office Address:	1737-158, Shirakata, Tokaimura, Naka-gun, Ibaraki-ken, Japan

Inventor:	Kazuo TSUTSUI
City of Residence:	Hitachiota-shi
State or Foreign Country:	Japan
Country of Citizenship:	Japan
Post Office Address:	3091-1, Mayumicho, Hitachiota-shi, Japan

As this action is being filed by and on behalf of the assignee, the undersigned acknowledges the requirement under 37 CFR §3.73 that, when the assignee of the entire right, title and interest seeks to take action in a matter before the USPTO with respect to a patent application, trademark application, patent, registration, or reexamination proceeding, the assignee must establish it ownership of the property to the satisfaction of the Commissioner, and submits that such requirement is satisfied by the following.

Hitachi, Ltd. , a Japanese corporation, whose principal office is located at 6, Kanda Surugadai 4-chome, Chiyoda-ku, Tokyo 100, Japan, is, at present by assignment, the owner of 100% interest in the above-identified application and the owner of 100% of any patent to be granted in the above-identified application by virtue of an assignment from the above-identified inventor(s) to assignee Hitachi, Ltd. as evidenced by the assignment recorded in the Patent and Trademark Office at Reel 5930, Frames 244-245, or for which a copy is attached.

The undersigned has reviewed all the evidentiary documents in the chain of title of the patent application, trademark application, patent, registration, or reexamination proceeding, and to the best of the undersigned's knowledge and belief, title is in the assignee seeking to take this action;

Further, the undersigned respectfully submits that the undersigned is assignee's authorized representative, i.e., is authorized by the assignee to sign on behalf of the assignee.

Accordingly, by the undersigned signature, assignee of the entire interest in the above-mentioned Letters Patent hereby assents to the aforementioned application, and herein offers to surrender the original patent.

HITACHI. LTD.

Date: '97-10-30

By: Katsuo Ogawa

Katsuo OGAWA, Patent Attorney
Director and General Manager
Intellectual Property Office
(Authorized Signing Officer)

Please type a plus sign (+) inside this box → [+]

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Patent and Trademark Office: U.S. DEPARTMENT OF COMMERCE
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#4

CHANGE OF CORRESPONDENCE ADDRESS
Application

Address to:
Assistant Commissioner for Patents
Washington, D.C. 20231

Application Number	08/937,439
Filing Date	September 25, 1997
First Named Inventor	FUKUSHIMA et al.
Group Art Unit	2412
Examiner Name	
Attorney Docket Number	500.30789R00

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I am the :

[ ] Applicant.

[ ] Assignee of record of the entire interest.
Certificate under 37 CFR 3.73(b) is enclosed.

[X] Attorney or agent of record .

Typed or Printed Name	Gregory E. Montone, Reg. No. 28,141
Signature	
Date	February 17, 1998

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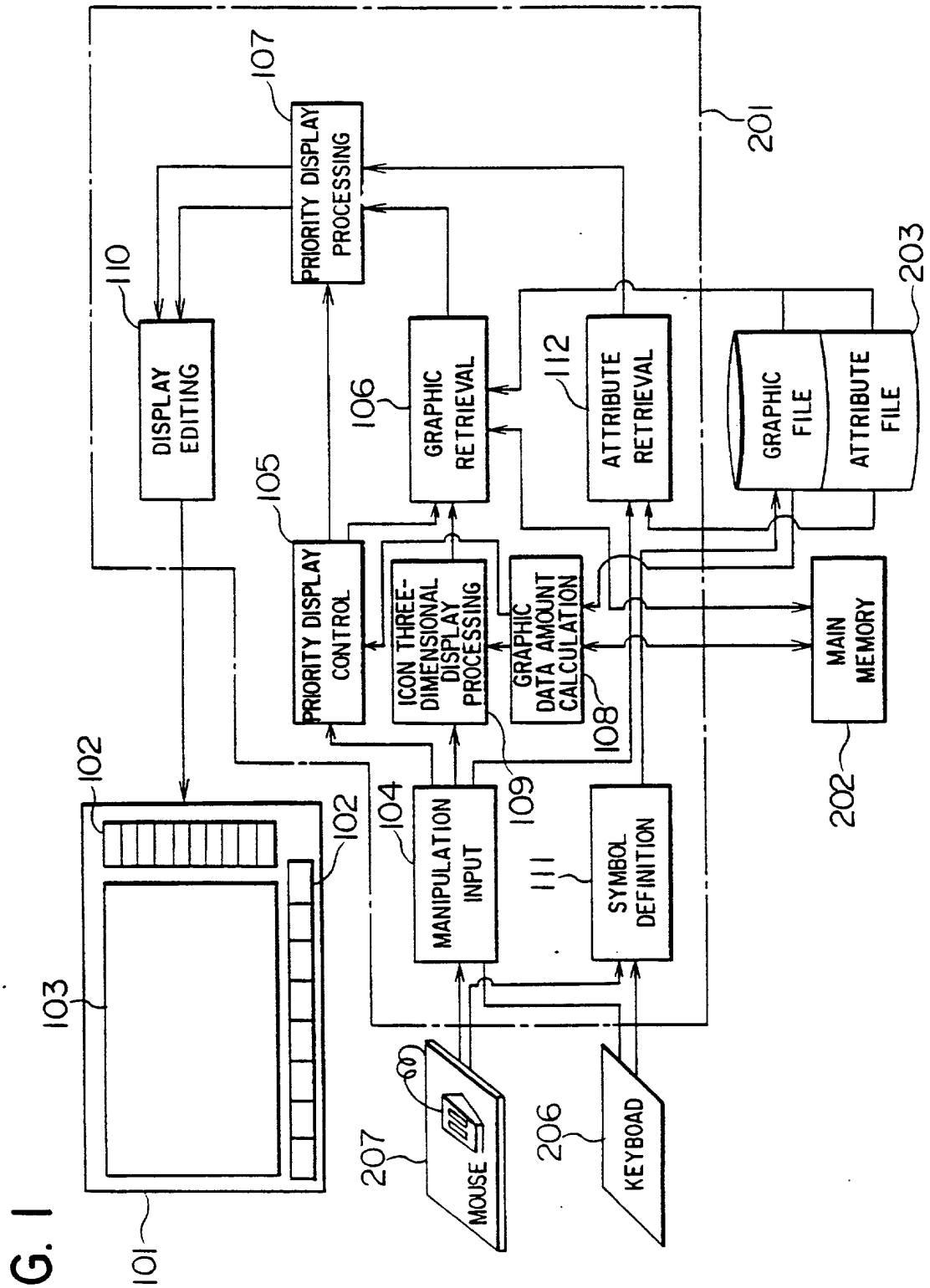

201
107
PRIORITY DISPLAY PROCESSING
110
DISPLAY EDITING
106
GRAPHIC RETRIEVAL
112
ATTRIBUTE RETRIEVAL
203
GRAPHIC FILE
ATTRIBUTE FILE
105
PRIORITY DISPLAY CONTROL
ICON THREE-DIMENSIONAL DISPLAY PROCESSING
GRAPHIC DATA AMOUNT CALCULATION
108
MAIN MEMORY
202
102
102
104
MANIPULATION INPUT
109
111
SYMBOL DEFINITION
103
207
MOUSE
206
KEYBOAD
101

FIG. 1

FIG. 2

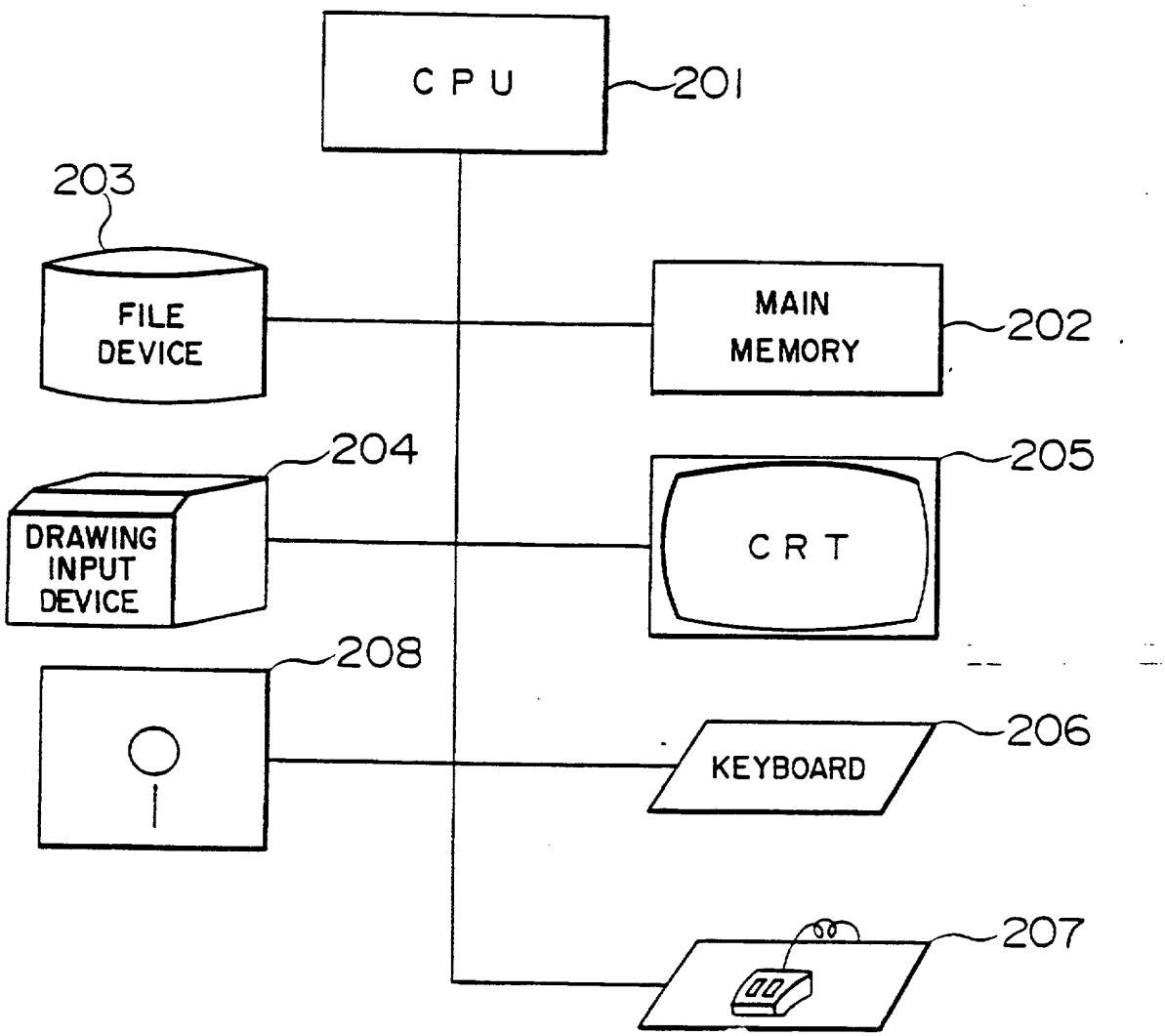

CPU
201
203
FILE DEVICE
MAIN MEMORY
202
204
DRAWING INPUT DEVICE
205
CRT
208
KEYBOARD
206
207

FIG. 3A

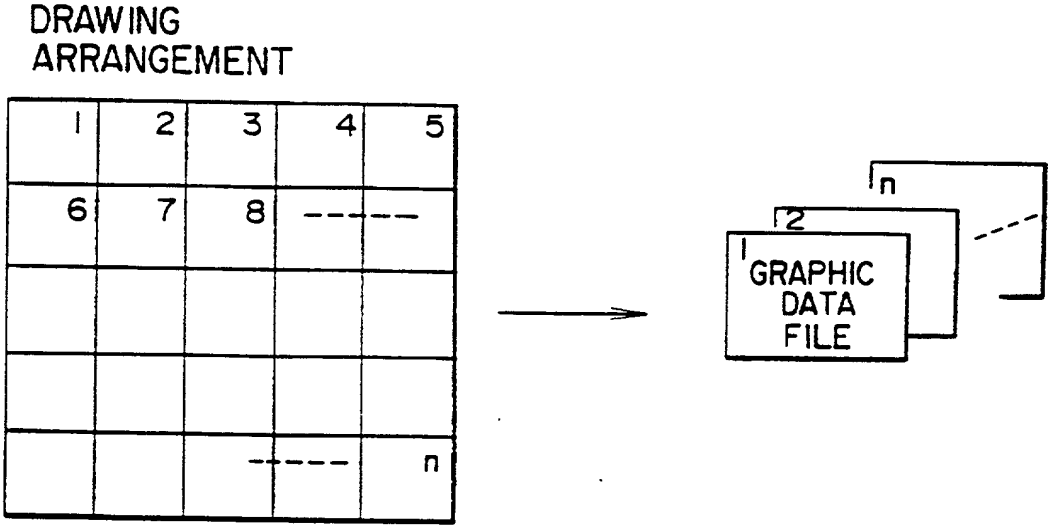


FIG. 3B

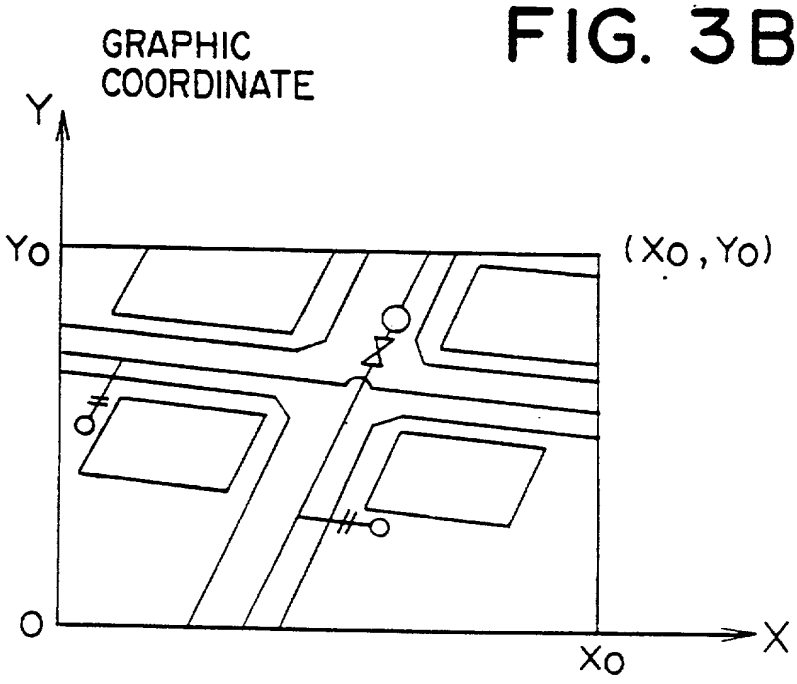


FIG. 4A

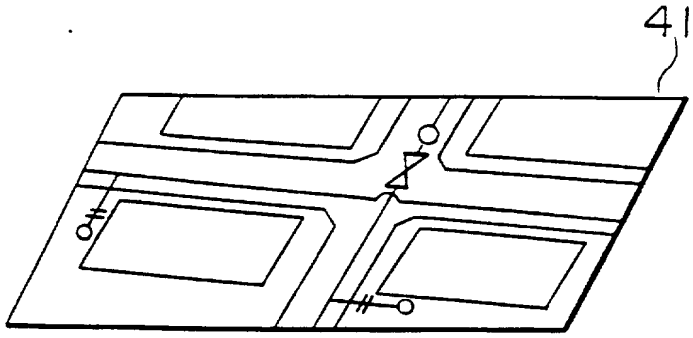


FIG. 4B

FIG. 4C

FIG. 4D

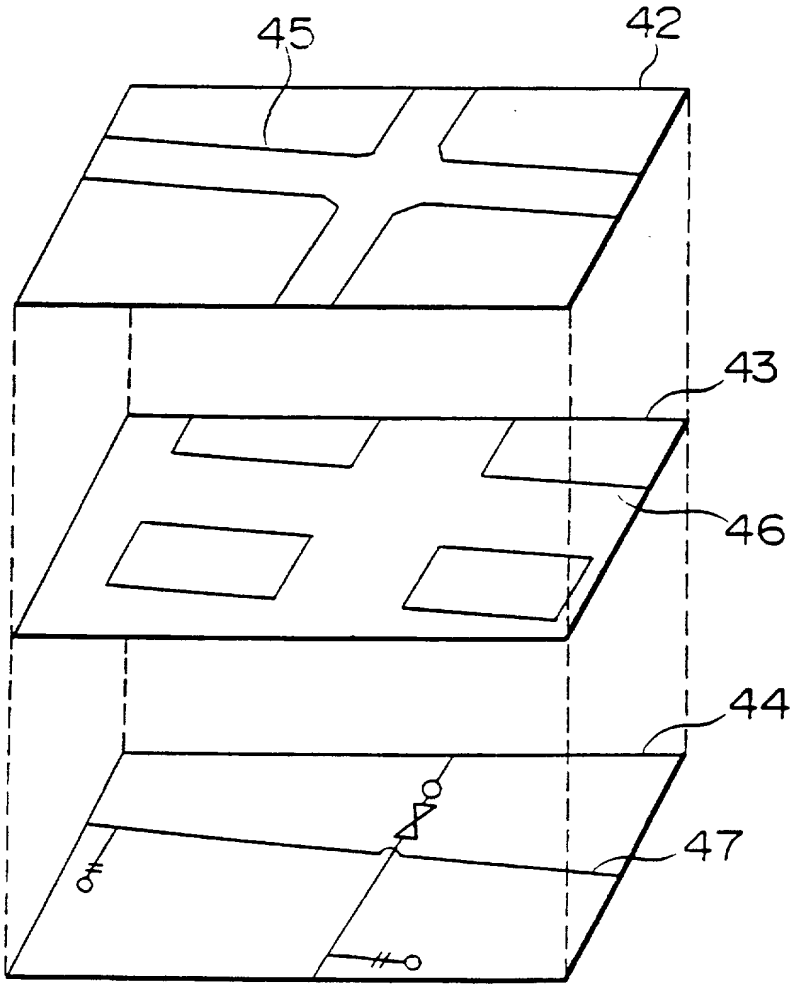


FIG. 5

10101	1
10102	3
10103	1
⋮	⋮
n	2

FIG. 6A

DRAWING DISPLAYED AT PRIORITY OF 1

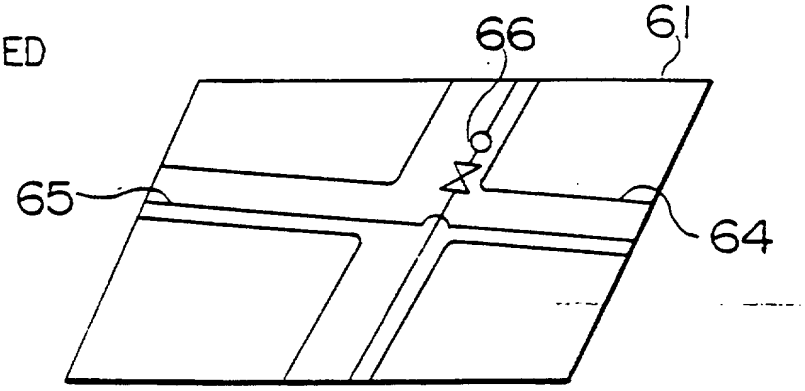


FIG. 6B

DRAWING DISPLAYED AT PRIORITY OF 2

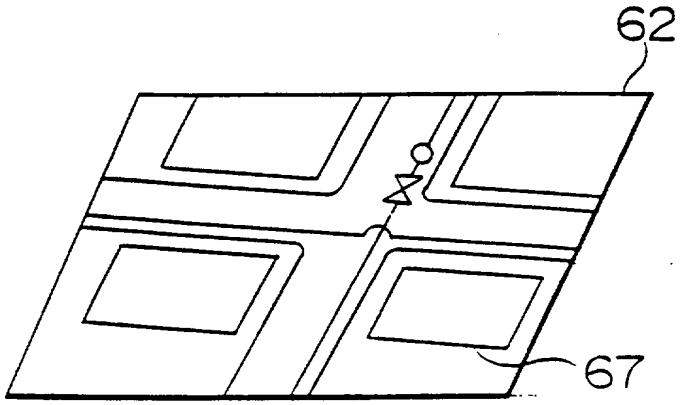


FIG. 6C

DRAWING DISPLAYED AT PRIORITY OF 3

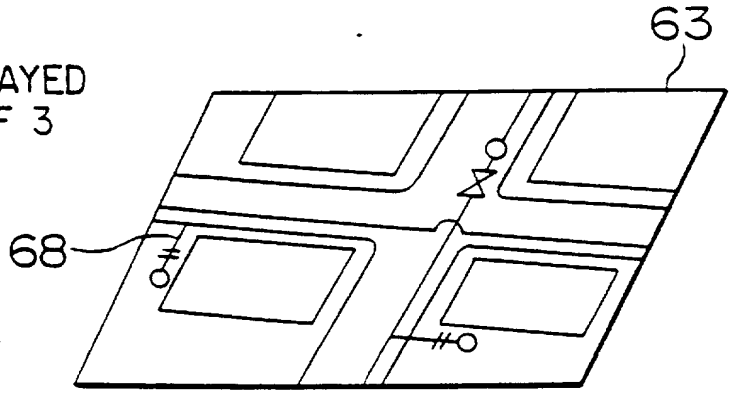


FIG. 7

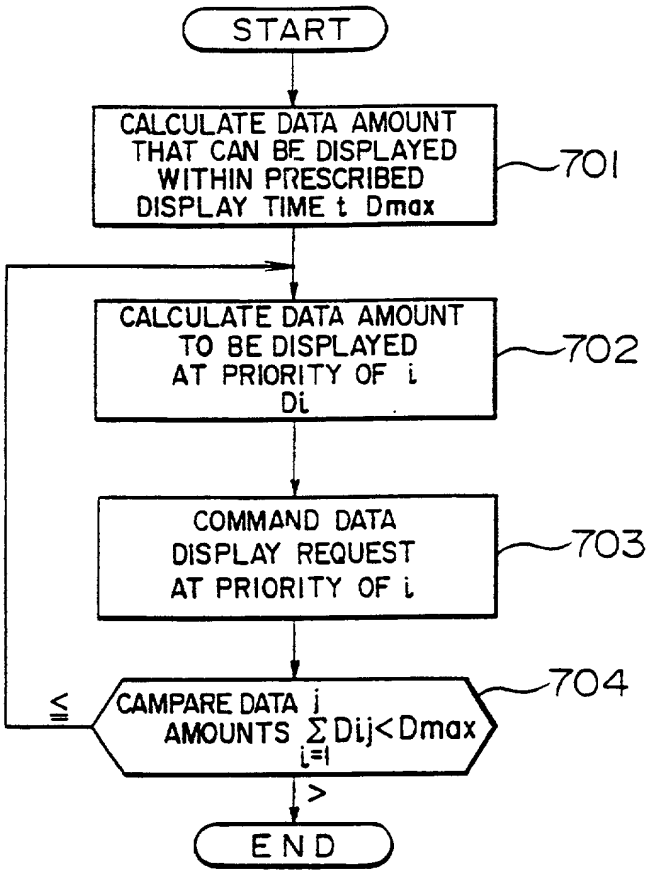

START
CALCULATE DATA AMOUNT THAT CAN BE DISPLAYED WITHIN PRESCRIBED DISPLAY TIME t Dmax
701
CALCULATE DATA AMOUNT TO BE DISPLAYED AT PRIORITY OF i Di
702
COMMAND DATA DISPLAY REQUEST AT PRIORITY OF i
703
CAMPARE DATA AMOUNTS $\sum_{i=1}^{j} Dij < Dmax$
704
≦
>
END

FIG. 8

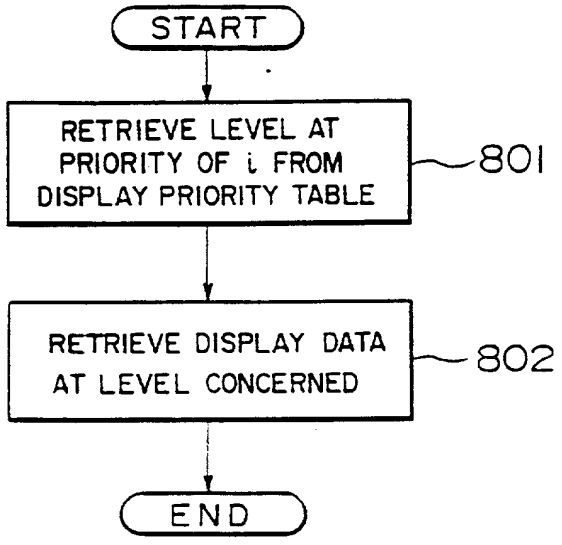

START
RETRIEVE LEVEL AT PRIORITY OF i FROM DISPLAY PRIORITY TABLE
801
RETRIEVE DISPLAY DATA AT LEVEL CONCERNED
802
END

FIG. 9A

TABLE OF GRAPHIC DATA CAPACITIES AT INDIVIDUAL LEVELS

GRAPHIC m

LEVEL NO.	GRAPHIC DATA CAPACITY
1	m_1

GRAPHIC b

GRAPHIC a

LEVEL NO.	GRAPHIC DATA CAPACITY
1	a_1
2	a_2
3	a_3
4	a_4
	b_n
	$\sum_{i=1}^{n} m_i$
n	a_n
Σ	$\sum_{i=1}^{n} a_i$

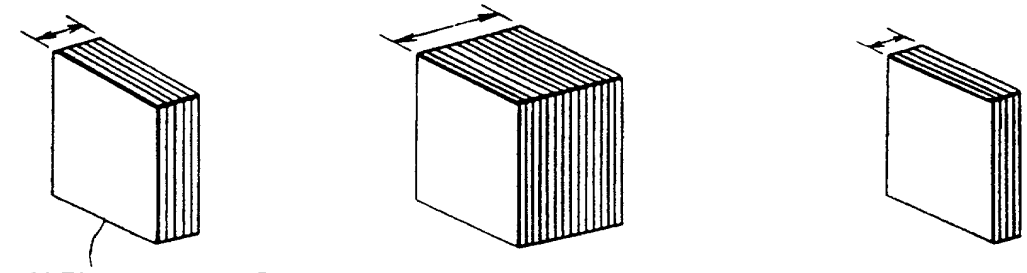
m_n

$\sum_{i=1}^{n} m_i$

FIG. 9B

SHAPE OF CORRESPONDING ICON

DEPTH (CORRESPONDING TO DATA AMOUNT)



REFERENCE PLANE

GRAPHIC a GRAPHIC b --------- GRAPHIC m

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FIG. 10

LEVEL NUMBER	SELECTION OF DISPLAY LAYER		CURRENT PRIORITY	AMOUNT OF CHANGING PRIORITY	PRIORITY AFTER HISTORY CHANGE
	ADDITION	CANCELLATION			
10101		O	1	+1	2
10102	O		3	-1	2
10103			1	0	1
10104	O		4	-1	3
------	------	------	------	------	------
n		O	2	+1	3

FIG. 11

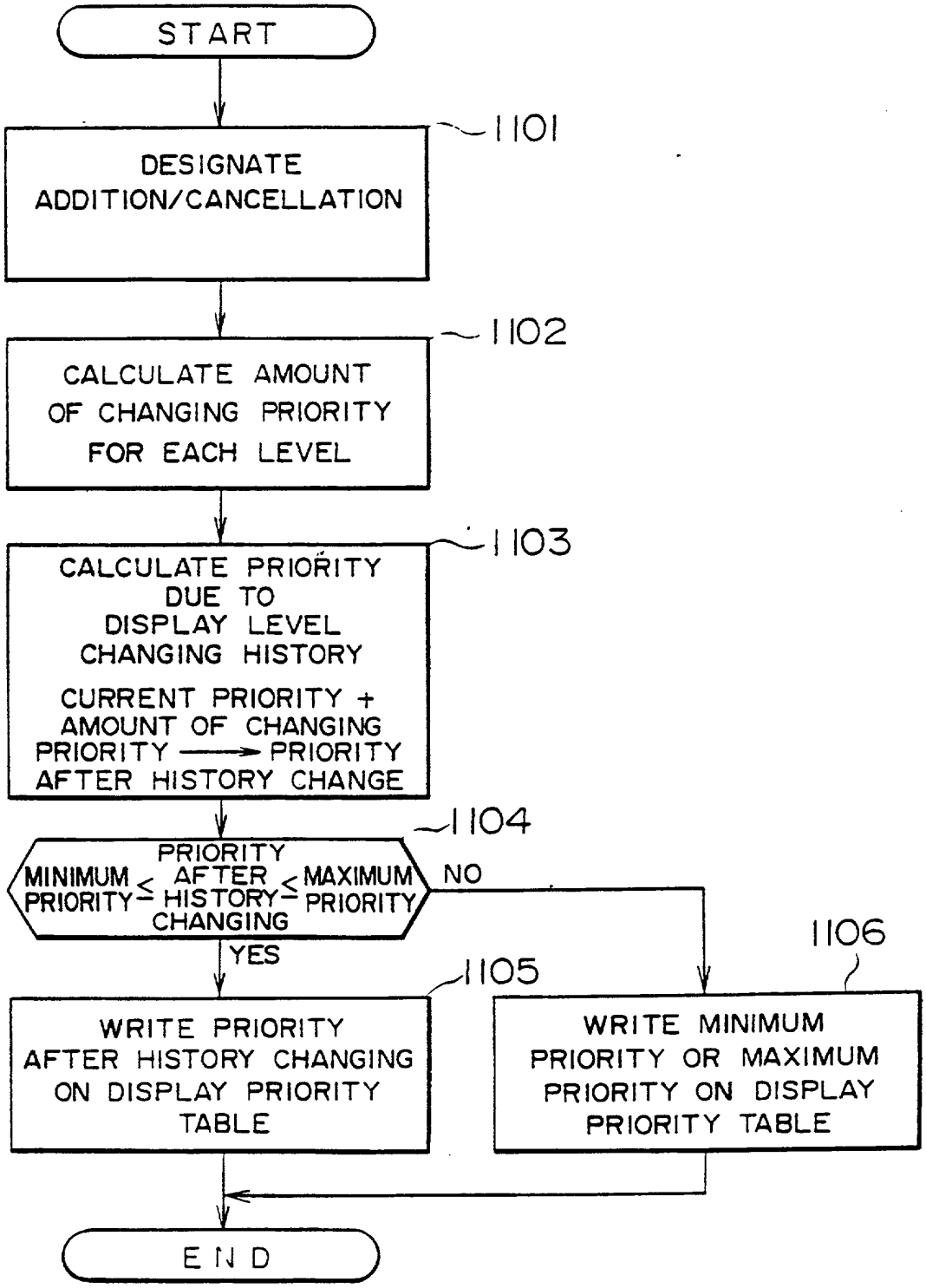
START
1101
DESIGNATE ADDITION/CANCELLATION
1102
CALCULATE AMOUNT OF CHANGING PRIORITY FOR EACH LEVEL
1103
CALCULATE PRIORITY DUE TO DISPLAY LEVEL CHANGING HISTORY
CURRENT PRIORITY + AMOUNT OF CHANGING PRIORITY → PRIORITY AFTER HISTORY CHANGE
1104
MINIMUM PRIORITY ≤ PRIORITY AFTER HISTORY CHANGING ≤ MAXIMUM PRIORITY
NO
YES
1105
WRITE PRIORITY AFTER HISTORY CHANGING ON DISPLAY PRIORITY TABLE
1106
WRITE MINIMUM PRIORITY OR MAXIMUM PRIORITY ON DISPLAY PRIORITY TABLE
END

FIG. 12

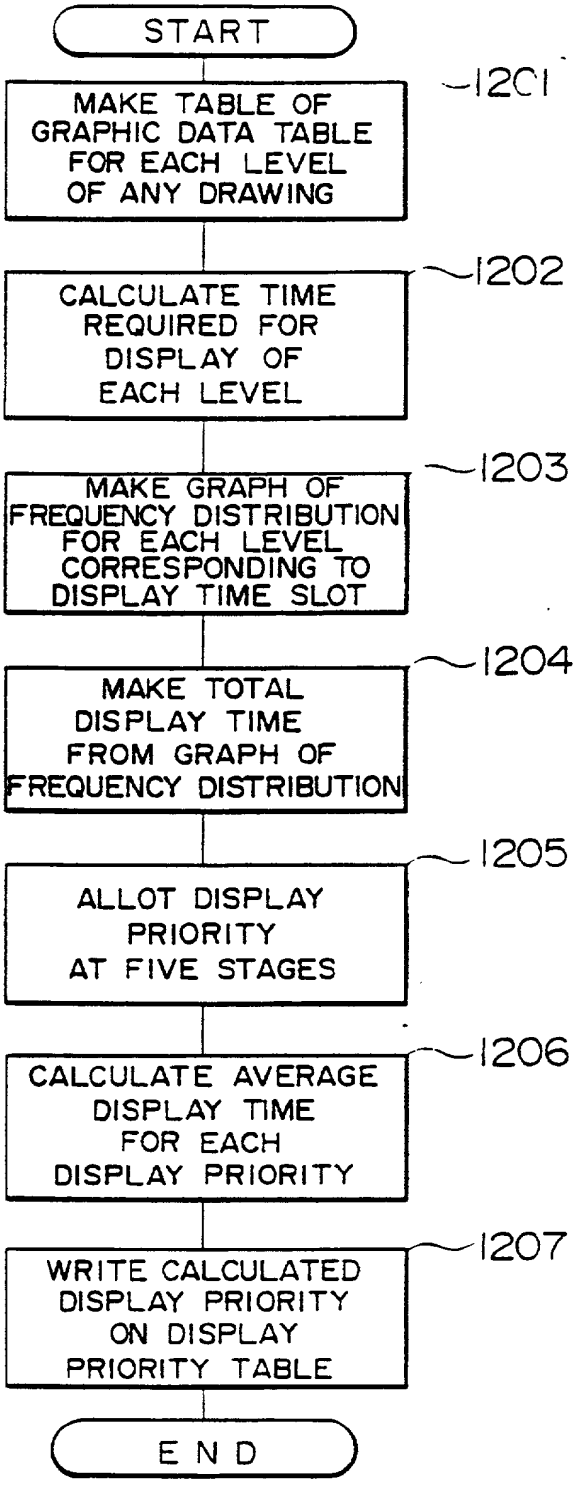
START
MAKE TABLE OF GRAPHIC DATA TABLE FOR EACH LEVEL OF ANY DRAWING
1201
CALCULATE TIME REQUIRED FOR DISPLAY OF EACH LEVEL
1202
MAKE GRAPH OF FREQUENCY DISTRIBUTION FOR EACH LEVEL CORRESPONDING TO DISPLAY TIME SLOT
1203
MAKE TOTAL DISPLAY TIME FROM GRAPH OF FREQUENCY DISTRIBUTION
1204
ALLOT DISPLAY PRIORITY AT FIVE STAGES
1205
CALCULATE AVERAGE DISPLAY TIME FOR EACH DISPLAY PRIORITY
1206
WRITE CALCULATED DISPLAY PRIORITY ON DISPLAY PRIORITY TABLE
1207
END

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FIG. 13A

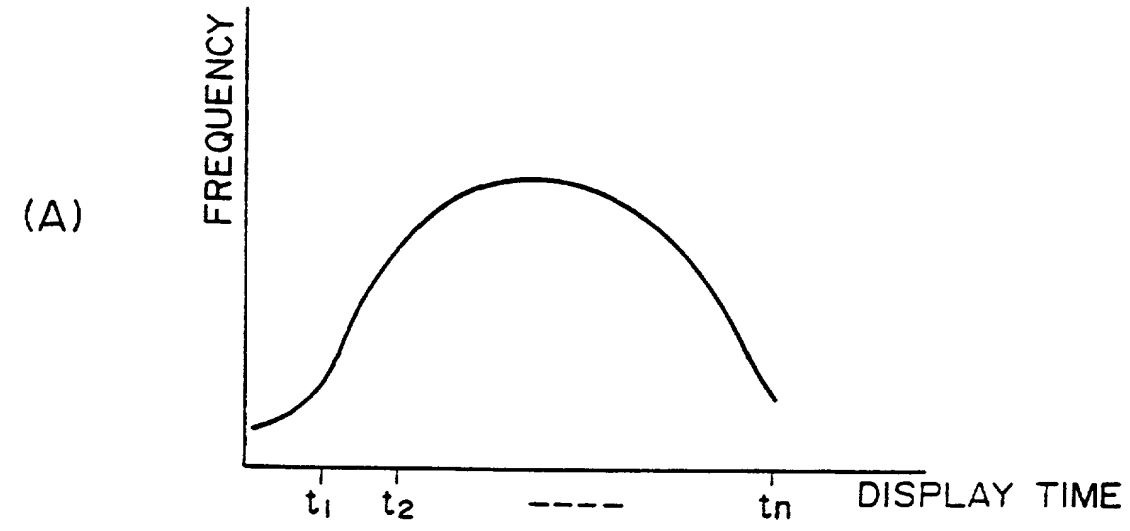

FIG. 13B